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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/905,172	07/13/2001	David S. Mui	004227 USA 02/ETCH/SILICO	2748

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 06/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/905,172

Applicant(s)

MUI ET AL.

Examiner

DuyVu n Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 July 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-34 is/are pending in the application.
- 4a) Of the above claim(s) 1-7 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-7 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4, 8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-7 drawn to a product, classified in class 430, subclass 323.
- II. Claims 8-34, drawn to a process, classified in class 438, subclass 689.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions in group II and group I are related as process of making and product made.

The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product made can be made by another and material different process such as using a wet etching process.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, restriction for examination purposes as indicated is proper.

5. During a telephone conversation with David Bonham on 3/5/03 a provisional election was made with traverse to prosecute the invention of process, claims 8-34. Affirmation of this election must be made by applicant in replying to this Office action. Claims 1-7 withdrawn from

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further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

7. The content of rejection under 103(a) and double patenting is the same; therefore, the rejections under 103(a) and double patenting have been put together as will be seen below.

Fairbairn et al. (US 6,573,030) is the same as U.S. Patent No. 6,573,030 and will be referred to as pat. '030.

Double Patenting

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 8-20, 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fairbairn et al. (US 6,573,030) and Kudo (US 6,420,261).

11. Claims 8-20, 27-29 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15-73 of U.S. Patent No. 6,573,030 in view of Kudo (US 6,420,261).

Referring to claims 8, 9, 17, and 27 pat. '030 (claims 15, 19, 20, 26-28, 33, 36, 37, 39, 43, 48, 53-56, 62, 63) describes a method for forming a device comprising: providing a substrate structure, depositing a amorphous carbon layer using hydrocarbon gas mixture such as propylene in a depositing chamber having P at 1-20 torr, RF power at 3-20 W/in², and T of 100-500 degree Celsius (claimed CVD organic layer comprising carbon and hydrogen), depositing an intermediate layer such as silicon oxynitride (claimed dielectric layer) over the amorphous carbon layer, providing a patterned energy sensitive resist (claimed pattern organic photoresist layer) over the dielectric layer, transferring the pattern from the resist to the dielectric layer (claimed etching the dielectric layer to form apertures in the dielectric layer), transferring the pattern from the dielectric layer to the amorphous carbon layer (claimed etching the organic layer

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to form apertures in the organic layer and this would form a mutliayer mask structure over the substrate having apertures and comprising the organic and dielectric layer), transferring the pattern from the amorphous carbon layer to the substrate (claimed etching the substrate structure through the apertures). Unlike claimed invention, above claims of pat. '030 do not describe transferring the pattern from one layer to another using plasma etching process. However, using plasma process for etching of organic layer, dielectric layers, and substrate structure is a well known technique to one skill in the art as shown here by Kudo. Kudo describes etching the organic layer, dielectric layers and substrate structure using a plasma etching process (col. 7, line 50-55, 63-col. 8, line 2). It would have been obvious at the time of the invention for one skill in the art to use a plasma process for the etching of the above layers in light of Kudo since Kudo describes further technique that facilitates the above transferring steps in order to form a semiconductor device with a reasonable expectation of success.

Referring to claims 12-14, pat. '030 (claims 48, 62, 63, 66-73) describes the deposition is done by applying RF power and the gas mixture, such as propylene and nitrogen, is decomposed when heated by the RF power. This would read on claimed the CVD organic is deposited by a PECVD process using a propylene and nitrogen gas.

Referring to claims 18-20, 28, 29, pat. '030 (claims 16, 17, 40, 41) describes the method further removing the amorphous carbon layer (claimed CVD organic layer) from the substrate using an oxygen plasma. This would read on claimed removing remnants of the CVD organic layer after the substrate structure is etched.

Referring to claims 15, 16, even though the claims of pat. '030 are silent about using an oxygen plasma to transfer the pattern to the organic layer (claimed etching the organic layer in a

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second plasma etching). However pat. '030 (claims 16, 17, 40, 41) describes the organic layer is removed (etched) with oxygen plasma in later step. Therefore, it would have been obvious to one skill in the art at the time of the invention to use oxygen plasma in order to transfer the pattern to the organic layer with a reasonable expectation of success.

Referring to claims 10, 11, Kudo further teaches etching the dielectric layer using fluorocarbon containing species (col. 6, line 19-25).

12. Claims 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fairbairn and Kudo as applied to claim 17 above, and further in view of Tsai et al. (US 6,083,815).

13. Claims 21-24 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15-73 of U.S. Patent No. 6,573,030 in view of Kudo (US 6,420,261) and Tsai et al. (US 6,083,815).

Referring to claims 21-24, pat. '030 (claims 15-73) doesn't describe the substrate further comprising a single silicon layer, an oxide layer over the single silicon layer, a doped polycrystalline silicon layer (will be referred as doped polysilicon layer) over the oxide layer and a native oxide layer over the doped polysilicon layer and etching the native oxide and the doped polysilicon layer using 2 etching plasma that comprises a halogen containing species. However, pat. '030 (claims 18, 42, 52) describes that the substrate can has one or more material layers formed thereon. Tsai describes a method for etching a substrate which comprising a single silicon layer, an oxide layer over the single silicon layer, a doped polysilicon layer over the oxide layer and a native oxide layer over the doped polysilicon layer and etching the native oxide and

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the doped polysilicon layer using 2 etching plasma processes that comprise halogen containing species to form a gate stack (col. 6, line 3-15, col. 7, line 1-6, 38-52). It would have been obvious for one skill in the art to modify the substrate of combined method above (pat. '030 and Kudo) in light of Tsai because pat. '030 (claims 18, 42, 52) describes that the substrate can have one or more material layers formed thereon, and Tsai further describes specific materials that the substrate of pat. '030 can have in order to form a gate electrode of a semiconductor device.

14. Claims 21, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fairbairn and Kudo as applied to claim 17 above, and further in view of Lou (US 6,200,881).

15. Claims 21, 25 and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 17-73 of U.S. Patent No. 6,573,030 in view of Kudo (US 6,420,261) and Lou (US 6,200,881).

Referring to claims 25 and 26, pat. '030 (claims 15-73) doesn't describe the substrate further comprising a single crystal silicon layer (will be referred as silicon layer), an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species. However, pat. '030 (claims 18, 42, 52) describes that the substrate can have one or more material layers formed thereon. Lou describes a method for etching a substrate which comprising a silicon layer, an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer, wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species (col. 3, line 50-col. 4,

line 15). It would have been obvious for one skill in the art to modify the substrate of combined method above (pat. '030 and Kudo) in light of Lou because pat. '030 (claims 18, 42, 52) describes that the substrate can have one or more material layers formed thereon and Lou further describes specific materials that the substrate of pat. '030 can have in order to form a shallow trench isolation of a semiconductor device.

16. Claims 30, 31, 33, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fairbairn et al. (US 6,573,030) and Chapman (US 5,967,769).

17. Claims 30, 31, 33, 34 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15-73 of U.S. Patent No. 6,573,030 in view of Chapman (US 5,976,769).

Patent '030 (claims 15, 19, 20, 26-28, 39, 43) describes transferring the pattern from the dielectric layer (intermediate layer), silicon oxynitride, to the amorphous carbon layer (claimed CVD organic layer comprising carbon and hydrogen). This would create mask having a CVD organic layer and a dielectric layer over the organic layer such that sidewall portions of the organic layer are exposed. Unlike claimed invention, pat. '030 (claims 15, 19, 20, 26-28, 39, 43) doesn't describe the step of etching exposed portions of the organic layer by using a plasma etching process such as the width of the mask features is reduced at the substrate. Chapman describes a method for providing sublithographic patterns wherein the exposed sidewalls of the organic layer is etched such that the width of the organic layer is reduced at the substrate using etching technique including plasma etch (figure 8a-8d; col. 5, line 15-col. 6, line 7). It would

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have been obvious for one skill in the art at the time of the invention to modify pat. '030 method in light of Chapman's method of etching the exposed sidewalls of the organic layer because it would provides a smaller linewidth than using conventional lithographic process and a smaller linewidth would be desired in fabrication of semiconductor circuits with high device density according to Chapman (col. 1, line 10-40).

Referring to claims 33 and 34, pat. '030 (claims 16, 17, 40, 41) describes the organic layer is removed (etched) with oxygen plasma in later step. Therefore, it would have been obvious to one skill in the art at the time of the invention to also use oxygen plasma to etch the exposed sidewalls of the organic layer in order to reduce its linewidth with a reasonable expectation of success.

18. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fairbairn and Chapman as applied to claim 30 above, and further in review of Cheng et al. (US 5,873,984).

19. Claim 32 is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15-73 of U.S. Patent No. 6,573,030 in view of Chapman (US 5,976,769) and Cheng et al. (US 5,873,984).

Referring to claim 32, pat. '030 (claims 29, 32, 64, 67) doesn't describe the organic layer has 70-80 % of carbon and 5-15 % of nitrogen. However, he describes the hydrogen is about 10-60%. Cheng further describes a method for forming an organic layer (amorphous carbon layer) having carbon, hydrogen, and nitrogen, where in the ratio of nitrogen and hydrogen is from 0.5-1.0 (col. 2, line 26, 27, col. 5, line 5, 6). It would have been obvious to one skill in the art to

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determine the ratio of the chemicals in the organic layer through routine experimentation in light of Cheng because the chemical concentration is result-effective variable as shown by Cheng as he tests different ratios of the nitrogen and hydrogen through test runs so that optimum ratio can be obtain to provide optimum result (col. 5, line 3-6) wherein the nitrogen and hydrogen concentration are similar.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD

June 5, 2003